

CLAIMS

What is claimed is:

1. A dispenser comprising:

a feeder bowl for receiving items to be dispensed;

5 a first vibration device for vibrating said feeder bowl;

a plurality of dispensing paths positioned around said feeder bowl; and

10 a rotation drive for rotating said dispensing paths, wherein said dispensing paths comprise at least one second vibration device for vibrating said dispensing paths proportionately to a physical characteristic of each of said items, such that said dispensing paths dispense said items singularly.

15 2. The dispenser of claim 1, wherein each of said dispensing paths is arc-shaped.

3. The dispenser of claim 2, wherein each of said arc-shaped dispensing paths curves in a direction opposite to a direction of rotation of said feeder bowl.

4. The dispenser of claim 1, wherein each of said dispensing paths extends radially from 15 said feeder bowl.

5. The dispenser of claim 1, wherein each of said dispensing paths receive said items directly from said feeder bowl.

6. The dispenser of claim 1, wherein each of said dispensing paths comprises at least one channel for dispensing items singularly.

20 7. The dispenser of claim 6, wherein a width and a depth of each of said channels increases as said channels extend from said feeder bowl.

8. The dispenser of claim 6, wherein said at least one second vibration device vibrates each of said channels together or independently.

9. The dispenser of claim 6, wherein said at least one second vibration device vibrates each 25 of said channels proportionately to a physical characteristic of said items.

10. The dispenser of claim 6, wherein said channels are positioned around a periphery of said feeder bowl and wherein said feeder bowl supplies said items to said channels.

11. The dispenser of claim 1, wherein each of said plurality of dispensing paths comprises a channel with a substantially smooth, item-dispensing surface or a textured, item-dispensing 30 surface.

12. The dispenser of claim 1, wherein said at least one second vibration device comprises a plurality of second vibration devices, each of which second vibration devices vibrates a respective dispensing path to dispense said items singularly.

13. The dispenser of claim 12, wherein each of said plurality of second vibration devices
5 vibrates each of said dispensing paths in two intersecting planes.

14. The dispenser of claim 13, wherein said two intersecting planes comprise a substantially horizontal plane and a substantially vertical plane.

15. The dispenser of claim 1, wherein said at least one second vibration device vibrates each of said dispensing paths proportionately to at least one physical characteristic selected from the
10 group consisting of a density of each of said items, a volume of each of said items, and a weight of each of said items.

16. The dispenser of claim 1, wherein said at least one second vibration device vibrates each of said dispensing paths in at two planes, said at least two planes being transverse to one another.

17. The dispenser of claim 6, further comprising:
15 a dispensing head positioned at a distal end of each of said channels for receiving said singularly-dispensed items, wherein each of said dispensing heads may direct predetermined quantities of items to a container or divert predetermined quantities of items away from a container.

18. The dispenser of claim 17, wherein said dispensing head comprises a scale.
19. The dispenser of claim 17, further comprising:
20 a sensing unit positioned at each of said dispensing heads.
21. The dispenser of claim 19, wherein said sensing unit measures at least one physical characteristic of each of said singularly-dispensed items and transmits said measurement to a control unit which activates said dispensing head to direct predetermined quantities of items to a
25 container or divert predetermined quantities of items away from a container.

22. The dispenser of claim 20, wherein said physical characteristic measured by said sensing unit is selected from the group consisting of a volume of each of said singularly-dispensed items, a weight of each of said singularly-dispensed items, and a density of each of said singularly-dispensed items.

22. The dispenser of claim 19, wherein said sensing unit is selected from the group consisting of an electromagnetic sensor, a scale, a photoelectric sensor, a proximity sensor, a capacitative sensor, a laser sensor, a fiber optic sensor, and an infrared sensor.

23. The dispenser of claim 1, wherein said feeder bowl is substantially hemispherical.

5 24. The dispenser of claim 1, wherein said feeder bowl comprises a plurality of lane dividers for guiding said items along an item-receiving surface of said feeder bowl.

25. The dispenser of claim 1, wherein said feeder bowl comprises a receiving surface selected from the group consisting of a substantially planar item-receiving surface, a substantially conical item-receiving surface, a substantially dome-shaped item-receiving surface

10 26. The dispenser of claim 1, wherein said feeder bowl comprises a substantially smooth item-receiving surface or a textured, item-receiving surface.

27. The dispenser of claim 1, wherein said feeder bowl comprises:

a first sloped member comprising:

a first sloped portion; and

15 a second sloped portion connected to the first sloped portion via a substantially cylindrical portion, wherein a first slope of the first sloped portion is less than a second slope of the second sloped portion;

a second sloped member positioned below the first sloped member to receive items from said first sloped member, wherein a third slope of at least a portion of the second sloped member

20 is greater than the second slope.

28. The dispenser of claim 27, wherein the second sloped member is connected to the plurality of dispensing paths, such that the second sloped member rotates with the plurality of dispensing paths.

29. The dispenser of claim 28, wherein the first sloped member is at least member selected

25 from the group consisting of a stationary member and a vibratory member.

30. The dispenser of claim 1, further comprising:

a bulk delivery apparatus; and

a bulk delivery drive for controlling a rate of delivery of items from said bulk delivery apparatus to said feeder bowl.

31. The dispenser of claim 30, wherein said bulk delivery apparatus comprises a hopper and wherein said bulk delivery drive comprises a hopper vibration device for vibrating said hopper and controlling said rate of delivery of items.

32. The dispenser of claim 30, further comprising:
5 a sensing unit for measuring said items delivered from said bulk delivery apparatus to said feeder bowl.

33. The dispenser of claim 32, wherein said sensing unit weighs said items delivered from said bulk delivery apparatus or counts said items delivered from said bulk delivery apparatus, or both.

10 34. The dispenser of claim 1, further comprising:
 a refrigeration unit enclosing said dispenser.

35. The dispenser of claim 1, where said first vibration device vibrates said feeder bowl, such that said feeder bowl supplies items uniformly to said dispensing paths, and wherein said at least one second vibration device vibrates each of said dispensing paths and said rotation drive rotates each of said dispensing paths, such that said dispensing paths dispense said items singularly.
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36. The dispenser of claim 1, wherein said first vibration device vibrates said feeder bowl independently of a vibration imparted by said at least one second vibration device to each of said dispensing paths.

37. The dispenser of claim 36, wherein said at least one second vibration device comprises a plurality of second vibration devices, each of which vibrates one of said dispensing paths proportionately to said physical characteristic of said items, such that said dispensing paths dispense said items singularly.
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38. The dispenser of claim 1, wherein said first vibration device vibrates said feeder bowl, proportionately to said physical characteristic of said items, such that said feeder bowl supplies said items uniformly to said dispensing paths.
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39. The dispenser of claim 1, wherein said physical characteristic comprises at least one physical property selected from the group consisting of a density of each of said items, a volume of each of said items, a weight of each of said items, a temperature of each of said items, and a frictional coefficient of a surface of each of said items.

30 40. A method of dispensing items from a dispenser comprising the steps of:

delivering a plurality of items onto a feeder bowl;
vibrating said feeder bowl, such that said items are supplied uniformly from said
feeder bowl to a plurality of dispensing paths positioned around said feeder bowl;
rotating said dispensing paths; and
5 vibrating said dispensing paths, such that said dispensing paths dispense said
items singularly.

41. The method of claim 40, wherein the step of rotating said dispensing paths comprises the
step of:

 rotating said dispensing paths around said feeder bowl.

10 42. The method of claim 40, wherein said step of vibrating said dispensing paths comprises
the step of:

 vibrating each of said dispensing paths independently of said vibration of said
feeder bowl.

43. The method of claim 40, further comprising the step of:

15 vibrating said feeder bowl and said dispensing paths proportionately to a physical
characteristic of each of said items, so that said feeder bowl supplies said items uniformly to said
dispensing paths and said dispensing paths dispensed said items singularly.

44. The method of claim 40, further comprising the steps of:

20 measuring a physical characteristic of each of said items as said items are
dispensed singularly from said dispensing paths; and

 counting each of said items whose measured physical characteristic is within said
predetermined range of physical characteristics.

45. The method of claim 179, wherein each of said dispensing paths comprises at least one
channel and wherein the step of vibrating said dispensing paths comprises the step of vibrating
25 said channels proportionately to a physical characteristic of each of said items, so that of each of
said channels dispenses items singularly.

46. The method of claim 40, further comprising the steps of:

 weighing each of said singularly-dispensed items; and

 identifying each of said items whose weight is greater than or less than a
30 predetermined range of weights.

47. The method of claim 40, further comprising the steps of:
measuring a density of each of said singularly-dispensed items; and
identifying each of said items whose densities is greater than or less than a predetermined range of densities.

5 48. The method of claim 40, further comprising the steps of:
measuring a volume of each of said items dispensed from said dispensing paths;
and
identifying each of said items whose volume is greater than or less than a predetermined range of volumes.

10 49. The method of claim 40, wherein each of said dispensing paths comprises at least one channel and wherein said step of vibrating said dispensing paths comprises the step of vibrating each of said channels independently of one another and of said feeder bowl.

50. The method of claim 40, wherein said step of vibrating said feeder bowl comprises the step of:
15 vibrating said feeder bowl in a substantially horizontal plane and a substantially vertical plane, or vibrating said feeder bowl in a first plane and a second plane, wherein said first plane and said second plane are transverse to one another.

51. The method of claim 40, wherein said step of vibrating said dispensing paths comprises the step of vibrating at least one channel of each of said dispensing paths in a substantially vertical plane.

20 52. The method of claim 40, wherein said step of vibrating said dispensing paths comprises the step of vibrating at least one channel of each of said dispensing paths in a substantially horizontal plane.

53. The method of claim 40, wherein said step of vibrating said dispensing paths comprises
25 the steps of:
vibrating each of said dispensing paths in a first plane and in a second plane,
wherein said first plane and said second plane are transverse to one another.

54. The method of claim 40, further comprising the step of:
vibrating said feeder bowl proportionately to at least one physical characteristic of
30 each of said items, wherein said physical characteristic is selected from the group consisting of a

density of each of said items, a volume of each of said items, a weight of each of said items, a temperature of each of said items, and a friction coefficient of a surface of each of said items.

55. The method of claim 40, further comprising the step of:

vibrating said dispensing paths proportionately to at least one physical characteristic of each of said items, wherein said physical characteristic is selected from the group consisting of a density of each of said items, a volume of each of said items, a weight of each of said items, a temperature of each of said items, and a friction coefficient of a surface of each of said items.

56. The method of claim 40, further comprising the steps of:

10 measuring a physical characteristic of each of said items dispensed from each of said dispensing paths; and

adjusting said vibration of said dispensing paths if any of said measurements indicate that said items are not being dispensed singularly, so that said dispensing paths dispense said items singularly.

15 57. The method of claim 40, further comprising the steps of:

measuring a physical characteristic of each of said items dispensed from said dispensing paths; and

diverting any of said items whose measured value is greater or less than a predetermined range of physical characteristics.

20 58. The method of claim 40, further comprising the steps of:

dispensing said items singularly from each of said dispensing paths to a respective dispensing head; and

directing predetermined quantities of said items from each of said dispensing heads to a respective container.

25 59. The method of claim 40, further comprising the steps of:

counting each of said singularly-dispensed items; and

directing predetermined quantities of said singularly-dispensed items to containers.

60. The method of claim 40, further comprising the steps of:

30 measuring each of said items;

identifying items whose measurement is greater than or less than a predetermined range of physical characteristics; and

diverting said identified items away from a container.

61. The method of claim 40, further comprising the step of:

5 supplying refrigerated air to said dispenser to maintain each of said items at a temperature of less than a predetermined temperature.

62. The method of claim 40, further comprising the steps of:

directing electromagnetic energy from a source onto a detector; and

10 measuring a volume of each of said items that pass between said source of electromagnetic energy and said detector based on a change in the level of electromagnetic energy detected by said detector.

63. The method of claim 40, further comprising the steps of:

measuring a level of electromagnetic energy received from a source of electromagnetic energy at a detector; and

15 measuring a change in said level of electromagnetic energy received at said detector as each of said items passes between said source and said detector.

64. The method of claim 40, further comprising the steps of:

positioning an electromagnetic energy source and a detector at a distal end of each of said dispensing paths;

20 passing each of said singularly-dispensed items between one of said electromagnetic sources and a respective one of said detectors;

measuring a change in a level of electromagnetic energy received by said detector as each of said items passes between said source and said detector ; and

calculating a volume of said items based on said measured changes.

25 65. The method of claim 40, further comprising the steps of:

measuring each of said items as they are dispensed from said dispensing paths; and

adjusting said vibration of said feeder bowl if any of said measurements indicate that said dispensing paths are not dispensing said items singularly.

30 66. The method of claim 40, further comprising the steps of:

measuring a physical characteristic of each of said items as they are dispensed from said dispensing paths; and

adjusting said vibration of said feeder bowl and said dispensing paths if any of said measurements indicate that said dispensing paths are not dispensing said items singularly.

5 67. The method of claim 40, further comprising the steps of:

measuring a physical characteristic of each of said items as they are dispensed; and

directing predetermined quantities of said items whose measured value is within a predetermined range of measurements to a container.

10 68. The method of claim 40, further comprising the steps of:

measuring a volume of each of said items as they are dispensed from said dispensing paths; and

dispensing predetermined volumes of said items to a container.

69. The method of claim 40, further comprising the steps of:

15 measuring a physical characteristic of each of said items as they are dispensed singularly from each channel of said dispensing paths; and

adjusting said vibration of said feeder and said dispensing paths if any of said measurements indicates that any of said channels of said dispensing paths are not dispensing said items singularly, so that said channels of said dispensing paths dispense said items singularly.

20 70. The method of claim 40, further comprising the steps of:

dispensing said items to a plurality of dispensing heads;

directing predetermined quantities of said items from each of said dispensing heads to a container.

71. The method of claim 40, further comprising the steps of:

25 dispensing said items to a plurality of dispensing heads;

directing predetermined volumes of said items from each of said dispensing heads to a container.

72. The method of claim 40, wherein said items are selected from the group consisting of a dried food item, a frozen food item, and a thawed food item.

30 73. The method of claim 40, wherein said items are non-food items.

74. The method of claim 40, further comprising the steps of:

measuring a physical characteristic of each of said items dispensed from said dispensing paths; and

adjusting a rotational speed of said dispensing paths if any of said measurements

5 indicate that said dispensing paths are not dispensing said items singularly, so that said dispensing paths dispense said items singularly.

75. The method of claim 40, further comprising the steps of:

delivering said plurality of items from a bulk delivery apparatus onto said feeder bowl;

10 measuring said delivered items; and

adjusting a rate of delivery of said plurality of items.

76. The method of claim 40, further comprising the steps of:

counting each of said singularly-dispensed items;

filling at least one dispensing head with a predetermined quantity of said 15 singularly-dispensed items; and

directing said predetermined quantity of said items to a container.

77. The method of claim 40, further comprising the steps of:

measuring a volume of each of said singularly-dispensed items;

filling at least one dispensing head with a predetermined volume of said 20 singularly-dispensed items; and

dispensing said predetermined volume of said items to a container.

78. The method of claim 76, wherein said dispensing head is filled with said predetermined quantity of said items before a container is conveyed to said dispensing head, such that said container may be filled upon arrival at said dispensing head.

25 79. The method of claim 77, wherein said dispensing head is filled with a predetermined volume of said items before a container is conveyed to said dispensing head, such that said predetermined volume may be dispensed to a container as soon as said container arrives at said dispensing head.

80. A rotary, vibratory dispenser comprising:

30 a feeder bowl for receiving items to be dispensed;

a first vibration device for vibrating said feeder bowl;
a rotation drive for rotating said feeder bowl; and
a plurality of dispensing paths positioned around said feeder bowl, wherein said dispensing paths rotate with said feeder bowl and comprise at least one second vibration device
5 for vibrating said dispensing paths proportionately to a physical characteristic of each of said items, so that said dispensing paths dispense said items singularly.

81. A method of dispensing items from a rotary, vibratory dispenser comprising the steps of:
delivering a plurality of items onto a feeder bowl;
rotating said feeder bowl;
10 vibrating said feeder bowl, such that said items are supplied uniformly from said feeder bowl to a plurality of dispensing paths positioned around said feeder bowl;
rotating said dispensing paths; and
vibrating said dispensing paths, so that said dispensing paths dispense said items singularly.